CLAIMS

What is claimed is:

1. A control system utilizing serial-data communication, in which the
serial-data communication between a host control apparatus and at least one
client control apparatus is performed, the control system comprising:

a means provided in the host control apparatus, for embedding
emergency-stop data in a serial-data communication frame when a
malfunction occurs inside the host control apparatus or when an
emergency-stop signal is inputted to the host control apparatus, for
embedding predetermined frame-error check data in the serial-data
communication frame each time the serial-data communication frame is
generated, and for outputting the frame to the client apparatus;

an extracting means provided in the client control apparatus, for
extracting the emergency-stop data and the frame-error check data from the
frame that is transmitted from the host control apparatus to the client
control apparatus; and

a means provided in the client control apparatus, for determining
whether or not the frame has been generated normally in the host control
apparatus by checking the frame-error check data extracted by the
extracting means, and for outputting to an apparatus to be controlled the
emergency-stop data when the emergency-stop data is embedded in the
serial-data communication frame and condition in which the frame is not
generated normally in the host control apparatus is continued for a duration
corresponding to a plurality of frames.

2. A control system utilizing serial-data communication, in which the serial-data communication between a host control apparatus and at least one client control apparatus is performed, the control system comprising:

5   a means provided in the client control apparatus, for embedding emergency-stop data in a serial-data communication frame to be outputted by the client control apparatus when a malfunction occurs inside the client control apparatus, for embedding predetermined frame-error check data in the serial-data communication frame to be outputted by the client control

10   apparatus each time the serial-data communication frame is generated, and for outputting the frame to the host control apparatus;

an extracting means provided in the host control apparatus, for extracting the emergency-stop data and the frame-error check data from the frame that is transmitted from the client control apparatus to the host

15   control apparatus; and

a means provided in the host control apparatus, for determining whether or not the frame has been generated normally in the client control apparatus by checking the frame-error check data extracted by the extracting means, and for determining that the client control apparatus is

20   out of order when the emergency-stop data is embedded in a serial-data communication frame and condition in which the frame is not generated normally in the client control apparatus is continued for a duration corresponding to a plurality of frames.

25   3. A control system utilizing serial-data communication, in which the

serial-data communication between a host control apparatus and a plurality of client control apparatuses, or among the plurality of client control apparatuses is performed, the control system comprising:

a means provided in the client control apparatus, for embedding
5   emergency-stop data in a serial-data communication frame to be outputted by the one client control apparatus when a malfunction occurs inside the client control apparatus or when an emergency-stop signal is inputted to the one client control apparatus, for embedding predetermined frame-error check data in the serial-data communication frame to be outputted by the
10   client control apparatus each time the serial-data communication frame is generated, and for outputting the frame to the host control apparatus and/or the other client control apparatus;

an extracting means provided in the client control apparatus, for extracting the emergency-stop data and the frame-error check data from the
15   frame that is transmitted from the host control apparatus and /or the other client control apparatuses to the client control apparatus; and

a means provided in the client control apparatus, for determining whether or not the frame has been generated normally in the host control apparatus and/or the other client control apparatus by checking the
20   frame-error check data extracted by the extracting means, and for outputting to an apparatus to be controlled the emergency-stop data when the emergency-stop data is embedded in the serial-data communication frame and condition in which the frame is not generated normally in the host control apparatus and/or the other client control apparatus is
25   continued for a duration corresponding to a plurality of frames.

4. The control system utilizing serial-data communication, according to any one of claim 1 through 3,

wherein the means for embedding the frame-error check data in the frame generates the frame-error check data to which a specific numerical value is added each time the serial-data communication frame is generated, when the frame is generated normally, and embeds the frame-error check data in the frame; and

wherein the means for determining compares previously received frame-error check data with presently received frame-error check data, and determines that the frame is not generated normally when a difference value between the previously received frame-error check data and the presently received frame-error check data is different from the specific numerical value.

5. A control system utilizing serial-data communication, in which the serial-data communication between a host control apparatus and a plurality of client control apparatuses, or among the plurality of client control apparatuses is performed, the control system comprising:

a means provided in the client control apparatus, for embedding emergency-stop data generated by the other client control apparatus in a frame to be outputted by the client control apparatus, and transmitting the frame to the host control apparatus and/or the other client control apparatus.

6. A control system utilizing serial-data communication, in which the serial-data communication between a host control apparatus and a plurality of client control apparatuses, or among the plurality of client control apparatuses is performed, the control system comprising:

5   a means provided in the client control apparatus, for embedding emergency-stop data generated in the control apparatus when a malfunction occurs inside the one control apparatus and emergency-stop data generated in the other control apparatus in a serial-data communication frame to be outputted by the client control apparatus, for, embedding predetermined

10   frame-error check data in the serial-data communication frame to be outputted by the client control apparatus each time the serial-data communication frame is generated, and for outputting the frame to the client control apparatus and/or the other client control apparatus;

       an extracting means provided in the client control apparatus, for

15   extracting the emergency-stop data and the frame-error check data from the frame that is transmitted from the host control apparatus, or the other client control apparatus, to the client control apparatus; and

       a means provided in the client control apparatus, for determining whether or not the frame has been generated normally in the host control

20   apparatus or the other client control apparatus by checking the frame-error check data extracted by the extracting means, and for outputting to an apparatus to be controlled the emergency-stop data when emergency-stop data is embedded in the serial-data communication frame and condition in which the frame is not generated normally in the host control apparatus or

25   the other client control apparatus is continued for a duration corresponding

to a plurality of frames.

7. The control system utilizing serial-data communication according to any one of claims 1 through 3 and 5 through 6, comprising:

5   a counting unit provided in the host control apparatus and/or the client control apparatus for counting the number of the received frames; and

      a means provided in the host control apparatus and/or the client control apparatus, for outputting the emergency-stop signal in the case 10 where a specific number of frames are not received.